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Applicants:	Pagotto Amadeo, et al.		Examiner: Joyner, Kevin
Application No:	10/684,314		Art Unit: 1797
Filed:	October 13, 2003		Confirmation No. 3316
Title:	TUNNEL FOR CONDITIONING PRODUCTS. .		

SUPPLEMENTAL DECLARATION OF JEFFREY H. MACKAY UNDER 37 C.F.R. §1.132 IN SUPPORT OF PATENTABILITY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Jeffrey H. Mackay, declare the following facts knowing them to be true of my own knowledge:

1. I am President and founder of Teo, Inc., assignee of the present patent application.

2. I have worked as a machinist/engineer since the early 1980s.

3. In the past, I have conducted extensive experimentation and design of mechanical and material properties and performance of pressurized food sterilization systems, including the machine automation, microwave application and computer modeling of dependent systems and

subsystems of pressurized food sterilization systems. I have designed pressure systems and worked with industry experts in developing pressurized food sterilization systems including collaborating with a contributing author of the ASME pressure vessel code.

4. I have extensive experience in the fields of food sterilization, food science, microwave systems, in both military and commercial applications, including direct experience as a technician and engineer for General Dynamics working on various air defense missile systems operating with RF, IR and UV spectrums. I have technical experience with high vacuum helium leak detection systems, high pressure 6000-9000 psi argon gas systems including their design, build and repair. Further, I have experience in the development of thermal validation technologies with advanced magnetic sensors.

5. Since April 2005, my responsibilities at TEO, Inc. have included overseeing the development and commercialization of microwave food sterilization systems based on my personal inventions and other patents and rights obtained.

6. Presently, I am a named inventor on two pending United States patent applications in the field of pressurized food sterilization systems.

7. I have filed previous declarations in support of the above identified application.

8. I would consider myself as one skilled in the art of pressurized food sterilization systems, particularly those employing microwave subsystems.

The Present Invention

9. The present application is directed to a product tunnel having a quadrilateral cross-section with microwave sources directly connected to the opposing sidewalls. As I explained in my previous declaration, the direct connection of the microwave sources to the sidewalls is not mere ornamentation which has no mechanical function. Instead, the direct connection of the microwave sources to the opposing sidewalls is extremely important because this reduces hardware within the microwave chamber which impacts the patterns and interactions of the microwave energy. In addition, the quadrilateral shape of the microwave exposure area with the direct connection of the microwave sources to the opposing sidewalls enables us to more accurately predict and adjust the interaction of the sources (including reflected microwave energy as described in the present patent application) to achieve the heating patterns we desire. By calculating wavelength, distance and media traveled through; the interaction of the microwave sources is tuned to create consistent predictable heating patterns. This is not possible, or at least beyond traditional modeling capability, for a microwave exposure area having reflective surfaces at oblique angles, or having circular, octagonal and otherwise a non-quadrilateral cross-section. The present invention requires the combination of a unique structure of a quadrilateral design with the positioning of the microwave sources attached directly to opposing sidewalls of the tuned structure.

10. Furthermore, the present invention includes microwave sources positioned at right angles (90°) to the advance of products. This construction is also extremely important. The microwave sources positioned at right angles (90°) to the advance of products *disadvantageously* increases microwave coupling and corresponding hot and cold spots within the chamber. However *advantageously*, the positioning of the microwave sources at right angles (90°) to the advance of products within a quadrilateral tunnel enables us to mathematically model standing wave patterns predictive of the interaction from the microwave sources and their interaction with the shape of the exposure cavity. Conversely, it is not possible to create a consistent predictable heating pattern, or at least beyond traditional modeling capability, for a microwave exposure area wherein the microwave sources are positioned at oblique angles to the advance of products in a non-quadrilateral exposure area. Merely introducing microwave sources from oblique angles, non-opposed, indirect sources, into non-quadrilateral, curved or irregularly shaped exposure areas would produce variable and unpredictable results in our system.

11. The unique structure of a quadrilateral design combined with positioning the microwave sources at right angles (90°) to the advance of products allows one to adjust phase of the incoming waveform to shift heating patterns within the geometry of the target product and control the interaction of the two opposing waveforms, including reflected waveforms as would be produced by the construction described in the present application. Again, this ability would be impossible, or at least beyond traditional modeling capability, for a microwave exposure area having reflective surfaces at oblique angles, circular, octagonal and otherwise a non-quadrilateral

cross-section. Thus, the shape of the structure and positioning of the microwave source entering that structure are relevant and significant to each other.

12. Until *Muller* (U.S. Patent No. 3,402,277 described below), no one had previously related the shape of the exposure structure to the relative positioning of microwave sources. *Muller* was actually extremely insightful and understood that the shape and positioning of microwave sources was important to product heating. However, as explained in greater detail below, *Muller's* octagonal microwave tunnel is constructed to achieve exactly the opposite microwave environment than the quadrilateral tunnel of the present invention.

Akutsu, Lipoma, and Ruozi

13. I have reviewed the present patent application serial no. 10/684,314. I have also reviewed U.S. Patent No. 4,809,596 naming *Akutsu* as the inventor; U.S. Patent No. 3,718,082 naming *Lipoma* as the inventor; and U.S. Patent No. 5,074,200 naming *Ruozi* as the inventor. Furthermore, I have reviewed the Patent Examiner's most recent *Office Action* dated March 4, 2010 issued in connection with patent application serial no. 10/684,314.

14. *Akutsu* does not disclose a cross-sectional configuration, and if one were to be implied it would be cylindrical based on Figure 1. *Akutsu* make no relation between the shape of the area where heat energy is applied and the source of the heat energy. The structure is merely an enclosure which houses an apparatus that utilizes a radiated heat source and a deflector (see 200). Furthermore, *Akutsu* illustrates a product drier. The construction would never be

positively pressurized in the wildest stretch of the imagination nor would anyone relate structures from a drying apparatus to a pasteurizer-sterilizer.

15. *Lipoma* does not disclose a preferred cross-sectional configuration, nor does it disclose placement of microwave sources, nor does is discose the structure of how they are attached or relate to the exposure area in any way. *Lipoma* indicates power sources can be located inside the chamber or provided through suitable waveguide. *Lipoma*, not *Akutsu* as misstated by the Patent Examiner, discloses that the "Pressurized Tank" may be any shape. Specifically, *Lipoma* states that the tank "may be rectangular or circular or elliptical or **any** other desired shape". (Emphasis added).

16. This statement clearly indicates that *Lipoma* saw no beneficial relationship between the manner in which the microwave energy is introduced into tunnel and/or the shape of the cavity/chamber. Clearly stating "any" shape is permissible exemplifies that the specific relationships between source positioning and cavity shape were not obvious. The author sees no benefit to shape and has so clearly stated. This conclusion is explicitly reinforced where *Lipoma* specifically disclaims at column 5, line 40, "the invention does not rely on any particular microwave oven".

17. *Ruozi* clearly defines the shape of the pressure vessel and does so as cylindrical. *Ruozi* also identifies the positioning of the microwave sources in relation to the conveyed food.

Ruozi does not affix the sources to the structure, instead microwave energy passes through a waveguide to adjacent the heated products.

18. From reading *Akutsu*, *Lipoma*, and *Ruozi*, it is clear that these inventors had absolutely no understanding that the conditioning tunnel shape and positioning of microwave sources was important to product heating.

Muller

19. *Muller* describes an octagonal tunnel wherein each of the microwave sources are positioned at *oblique* angles relative to the travel of products. Obviously, this is very different than the tunnel construction of the present invention having a quadrilateral tunnel and microwave source that are positioned at *right* angles relative to the travel of products (which *Muller* specifically seeks to avoid). Moreover, it is important to understand why *Muller* constructed his tunnel in such a manner.

20. *Muller* is the oldest and only reference that I have read where it is clear that the author understood that the shape of the exposure structure and the number and relative positioning of microwave sources was important to product heating. In my opinion, *Muller* was brilliant and his patent is the only prior art uncovered so far that has shown any knowledge of how microwaves interact with the environment (exposure area) in which they are introduced.

21. In all the other cited prior art, the inventors are merely describing an enclosure (envelope) to house their various apparatus. They did not understand that the tunnel construction and positioning of microwave sources has a dramatic impact on the creation of hot spots and cold spots during the heating process. Conversely, *Muller* clearly understood that the tunnel construction and positioning of microwave sources has a dramatic impact on the creation of hot spots and cold spots during the heating process. To overcome these problems, *Muller* attempts to eliminate hot and cold spots within the exposure area by creating a series of oblique angled introductions of microwave energy and angled reflecting surfaces.

22. First, *Muller* sets up his octagon with obliquely angled facets (Col. 1, line 54) and then introduces energy in a spiraling sequence along the oblique facets (Col. 2, lines 12 – 41). *Muller* continues with this oblique introduction of energy to facilitate "sufficiently good decoupling" (Col. 2, line 29) by attaching waveguide to the facets at an angled introduction. *Muller* spirals the introduction of these sources along the direction of travel and bends the waveguides after an undefined point to aid in construction. Furthermore, *Muller* is particularly insightful by understanding the issues related to potential damage to the generators in the event larger objects pass closely to a microwave source openings in the chamber causing reflected energy to flow back through the waveguide. To overcome this problem, he describes a baffle to reflect such energy back into the chamber in fig. 2-3. *Muller* also discusses a Polarizing grid which he does not describe in any detail either in configuration or function. All of these various constructions are provided to decrease microwave coupling and increase the randomization and uniformity of microwave energy in the *Muller* octagonal tunnel.

23. Meanwhile, the apparatus of the present invention is the exact opposite of *Muller* in both configuration of the apparatus and functional intent. Whereas, *Muller's* construction is intended to randomize microwave energy and reduce coupling to reduce hot and cold spots, the construction of the present invention, with a quadrilateral tunnel and microwave source that are positioned at *right* angles relative to the travel of products, actually encourages microwave field coupling allowing for the creation of predictable stable hot and cold patterns. These patterns can be predicted allowing for tuning to achieve a stable pattern with minimal thermal deviation. The ability to maintain a stable pattern of heating in an exposure allows for layering of additional exposures with complementary patterns to produce uniform heating.

Summary

24. The present invention requires the combination of a unique structure of a quadrilateral design with the microwave sources affixed to opposing sidewalls and attached directly to that tuned structure. The structure as defined allows one to adjust the phase of the incoming waveform to shift heating patterns within the geometry of the target product and control the interaction of the waveforms. Furthermore, the claimed structure allows one to adjust the phase of the incoming waveform to shift heating patterns within the geometry of the target product.

25. Spanning back to 1966 (*Muller*), only *Muller* had conceived of the structural relationship between cavity shape and microwave source placement. Instead, the prior art, and

specifically *Akutsu, Lipoma,* and *Ruozi,* all have merely created an envelope (cavity) to contain their invention. *Akutsu, Lipoma,* and *Ruozi* all utilize the pressure vessel as a "tank" enveloping the described mechanical apparatus. They do not define or imply in any way a desired embodiment for the shape and configuration of a structure for the application of microwave energy. As a result, the prior art references describe structures which would introduce microwaves into vessels which would create a random pattern of reflection within the area of exposure. *Akutsu, Lipoma,* and *Ruozi* dump energy non-specifically into a shell which chaotically heats rendering unpredictable shifting hot and cold spots.

26. Meanwhile, Muller clearly recognized that the shape and configuration of a structure was important for the application of microwave energy. However, he approached the problem in an entirely different manner than the present invention. *Muller* sought to create an infinitely random decoupled microwave environment within a conditioning tunnel to promote uniformity in heating. Conversely, the present invention is directed to creating a stable predictable microwave environment accepting inherent coupling and heating patterns that are stable, can be predicted and controlled.

27. Because the approaches sought to be achieved by the present invention and *Muller* are so different, the resulting tunnel constructions are very different. The tunnel of the present invention is quadrilateral, whereas *Muller's* is octagonal and compels oblique angles. The tunnel of the present invention possesses microwave sources that are positioned at *right* angles so as to introduce energy in a manner where coupling shall occur and is intended.

Moreover, the quadrilateral structure and stable coupling creates a single predictable mode analogous to that of a single constant tone of microwave energy. This provides for more predictable patterns allowing for more intense energy application. Conversely, the *Muller* tunnel possesses microwave sources including reflective surfaces that are positioned at *oblique* angles to avoid coupling and create a multi-mode of effectively a white noise of microwave energy.

28. It is also clear that one skilled in the art would not look to modify the *Muller* tunnel to be quadrilateral and to have microwave sources that are positioned at *right* angles. This modification would destroy *Muller's* proclaimed purpose to eliminate microwave coupling with the intent to provide an infinitely random microwave environment. Conversely, the structure of the present invention seeks to create the opposite environment accepting and utilizing coupling to produce a stable pattern that can be predicted.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this 30th day of June ___, 2010 at San Diego, California.

By:
Jeffrey H. Mackay
CEO
Teo, Inc.